WOODLAND
TRUST SCOTLAND

Portmoak Moss

Management Plan
2017-2022

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MAPS

THE WOODLAND TRUST

INTRODUCTION

The Trust's corporate aims and management approach guide the management of all the Trust's properties, and are described on Page 4. These determine basic management policies and methods, which apply to all sites unless specifically stated otherwise. Such policies include free public access; keeping local people informed of major proposed work; the retention of old trees and dead wood; and a desire for management to be as unobtrusive as possible. The Trust also has available Policy Statements covering a variety of woodland management issues.

The Trust's management plans are based on the identification of Key Features for the site and setting objectives for their management. A monitoring programme (not included in this plan) ensures that these objectives are met and any necessary management works are carried out.

Any legally confidential or sensitive species information about this site is not included in this version of the plan.

PLAN REVIEW AND UPDATING

The information presented in this Management plan is held in a database which is continuously being amended and updated on our website. Consequently this printed version may quickly become out of date, particularly in relation to the planned work programme and on-going monitoring observations.
Please either consult The Woodland Trust website www.woodlandtrust.org.uk or contact the Woodland Trust (wopsmail@woodlandtrust.org.uk) to confirm details of the current management programme.

There is a formal review of this plan every 5 years and a summary of monitoring results can be obtained on request.

WOODLAND MANAGEMENT APPROACH

The management of our woods is based on our charitable purposes, and is therefore focused on improving woodland biodiversity and increasing peoples' understanding and enjoyment of woodland.

Our strategic aims are to:

- Protect native woods, trees and their wildlife for the future
- Work with others to create more native woodlands and places rich in trees
- Inspire everyone to enjoy and value woods and trees

All our sites have a management plan which is freely accessible via our website www.woodlandtrust.org.uk. Our woods are managed to the UK Woodland Assurance Standard (UKWAS) and are certified with the Forest Stewardship Council® (FSC®) under licence FSC-C009406 and through independent audit.

In addition to the guidelines below we have specific guidance and policies on issues of woodland management which we review and update from time to time.

We recognise that all woods are different and that the management of our sites should also reflect their local landscape and where appropriate support local projects and initiatives. Guidelines like these provide a necessary overarching framework to guide the management of our sites but such management also requires decisions based on local circumstances and our Site Manager's intimate knowledge of each site.

The following guidelines help to direct our woodland management:

1. Our woods are managed to maintain their intrinsic key features of value and to reflect those of the surrounding landscape. We intervene when there is evidence that it is necessary to maintain or improve biodiversity and to further the development of more resilient woods and landscapes.
2. We establish new native woodland using both natural regeneration and tree planting, but largely the latter, particularly when there are opportunities for involving people.
3. We provide free public access to woods for quiet, informal recreation and our woods are managed to make them accessible, welcoming and safe.
4. The long term vision for our non-native plantations on ancient woodland sites is to restore them to predominantly native species composition and semi-natural structure, a vision that equally applies to our secondary woods.
5. Existing semi-natural open-ground and freshwater habitats are restored and maintained wherever their management can be sustained and new open ground habitats created where appropriate.
6. The heritage and cultural value of sites is taken into account in our management and, in particular, our ancient trees are retained for as long as possible.
7. Woods can offer the potential to generate income both from the sustainable harvesting of wood products and the delivery of other services. We will therefore consider the potential to generate income from our estate to help support our aims.
8. We work with neighbours, local people, organisations and other stakeholders in developing the management of our woods. We recognise the benefits of local community woodland ownership and management. Where appropriate we allow our woods to be used to support local woodland, conservation, education and access initiatives.
9. We use and offer the estate where appropriate, for the purpose of demonstration, evidence gathering and research associated with the conservation, recreational and sustainable management of woodlands. In particular we will develop and maintain a network of long-term monitoring sites across the estate.
10. Any activities we undertake will conform to sustainable forest management principles, be appropriate for the site and will be balanced with our primary objectives of enhancing the biodiversity and recreational value of our woods and the wider landscapes.

SUMMARY

This public management plan briefly describes the site, specifically mentions information on public access, sets out the long term policy and lists the Key Features which drive management actions. The Key Features are specific to this site – their significance is outlined together with their long (50 year+) and short (5 year) term objectives. The short term objectives are complemented by a detailed Work Programme for the period of this management plan. Detailed compartment descriptions are listed in the appendices which include any major management constraints and designations. A short glossary of technical terms is at the end. The Key Features and general woodland condition of this site are subject to a formal monitoring programme which is maintained in a central database. A summary of monitoring results is available on request.

1.0 SITE DETAILS

Site name:	Portmoak Moss
Location:	Scotlandwell
Grid reference:	NO179014, OS 1:50,000 Sheet No. 58
Area:	43.59 hectares (107.71 acres)
Designations:	

2.0 SITE DESCRIPTION

2.1 Summary Description

The woodland consists mainly of mature conifer plantation, along with some mixed woodland and native broadleaved woodland. At the core of the site is a large open area of raised bog habitat (an area of deep peat), one of few remaining in central Scotland. As a result the wood is a refuge for a variety of wildlife including red squirrels. There is good access for walkers, etc and part of the site has an all-weather looped trail of 400m which is flat and suitable for buggies. Reached via access track south of the village of Scotlandwell.

2.2 Extended Description

The site consists partly of mature conifer plantation woodland and partly of an open area of raised bog

Location, Altitude and Aspect
Portmoak Moss is located approximately 200m south west of the village of Scotlandwell, in Perth and Kinross. and is located on flat ground (approximately 110m in altitude) between Loch Leven and the Lomond Hills. The site is relatively flat with a central raised dome of peat. The wood is visible from the Loch and surrounding roads as well as from the popular walks on the Lomond Hills. The climate for the Portmoak area is recorded as being that typical of fairly warm, moist lowland and foothill. The area is moderately exposed with moderate winters.

Physical Description
The underlying geological formations at Portmoak are mainly fluvial and of yellow and reddish-brown sandstone. This is overlain by glacial deposits of clay, and then course lake muds. The upper profiles are of deep peat. The peat would originally have been in the form of a dome, which is typical of a lowland raised bog. The peat is formed mainly from the semi-decomposed remains of thousands of years of growth of sphagnum moss that has gradually built up since the end of the last ice age. In hydrological terms, such bogs are entirely rain-fed and the peat sustains a raised water table which enables the growth of moisture-loving sphagnum moss. Over recent centuries the outer part of the peat dome has been cut for fuel, leaving only the centre of the raised area intact, surrounded by a sheer face of cut peat from 2 to 3m high. On the lower levels the peat depth goes down to 3m. In the centre of the dome the depth reaches 6m. There are numerous drainage channels on both the raised and lower parts, dug in an attempt to drain the site for peat cutting, grazing and forestry. Some of these date to the 1960's forestry planting, but some of the main drains are present on mid-19th century maps. This resulted in a lowering of the water table to the point where sphagnum, which remained in patches, was struggling to survive. A series of combined works during the last plan period, as part of the restoration of the core area of the raised bog, have resulted in a gradual rise in the water table over parts of the site.

Site History
The peat deposits at Portmoak originally developed in a wet hollow left after the last ice-age. As peat deposition increased, this eventually became a raised dome.

In the middle ages, the area was part of a much larger uncultivated bog providing peat, turf and pasture to local communities. Peat may also have fuelled local lime kilns and a distillery. Use of the Moss for peat cutting by residents of Scotlandwell and Kinnesswood is well documented from the 17th to the 20th century, after which the practise of peat cutting ended.

The earliest mapped woodland on the site dates from the mid-1800’s and includes patches of woodland in the south-west and north of the site. These two areas, totalling 5 ha, are recorded in the Ancient Woodland Inventory as being Long Established Woodland of Plantation Origin (LEPO). A 1947 aerial photograph shows only a slight expansion of these areas, along with other scattered trees.

The site was bought by the Forestry Commission in the early 1960’s and the site was drained and planted predominately with commercial conifers. It was acquired by the Woodland Trust in 1996, with combined funding from the Heritage Lottery Fund, Scottish Natural Heritage and considerable local and Woodland Trust fundraising efforts. The on-going process of restoring part of the site to a functioning raised bog habitat began in 2000, and covers a core central area of approximately 12 hectares.

Woodland Habitat
The woodland consists mainly of unthinned commercial conifer stands planted between 1960 and 1963. The main planted species are: Sitka spruce and Scots pine, with some Norway spruce, lodgepole pine, hybrid larch and sycamore. There are several areas of established and developing Wet Woodland - NVC-W4c throughout the site, dominated by downy birch and willow species, with the occasional silver birch, rowan and oak. These areas are often rich in sphagnum sub communities, ferns, fungi, grasses and lichens. Occasional mature specimens of Scots pine, along

with grand and noble fir are also found on site. Some areas of semi-natural birch scrub remain, particularly along the boundary. Poorly drained soils, including deep raised bog peats in places, combined with a high water table and lack of thinning of the commercial conifers has resulted in drawn up stands which are increasingly unstable and prone to wind throw and wind snap. As a result windthrow amongst the more commercial conifers (Sitka and Norway spruce) is increasing throughout the site. Some parts of the woodland are classed as Long Established Woodland of Plantation Origin (LEPO), as they appear on a map dated 1856. These were early attempts to drain and afforest the bog. Little evidence of these early attempts at afforestation now remains, except for the occasional mature Scots pine.

The broadleaved woodland component consists predominantly of downy birch and willow species in the wet areas, but there are also occasional oak, rowan, silver birch, willow, sycamore and ash on the drier soils. Many of these are juvenile to early mature trees that have regenerated in open areas where the conifers did not establish well, although there are also mature trees present which may predate the conifers. An area of natural regeneration in the southeast of the site is now well established and gradually developing into a wet woodland habitat of dense downy birch and willow species with occasional rowan - following clearance of windblown conifers in 2000. Due to a lack of thinning in the commercial conifer crops many of the slower growing trees have gradually died off, many of which remain standing within the canopy. As a result there is currently an abundance of standing and fallen deadwood within the commercial conifer stands.

Amongst the dense stands of spruce the ground flora and understorey ranges from very low to virtually non-existent. In the more open stands and along rides and drain edges, the ground flora is dominated by common damp woodland species (NVC classes W4 and W16) such as broad-buckler fern, wavy hair-grass and a high proportion of mosses including Polytrichum and remnants of various sphagnum species. Drier boundaries tend to be dominated by bracken and brambles. In the drier but more nutrient-poor areas on the core area of raised bog there are large swaths of grasses and regular patches of blaeberry and heather. Areas containing high proportion of species diversity provide the main nature conservation interest within the woodland, in terms of both ground flora and fauna.

Open Raised Bog Habitat
An on-going series of projects aimed at gradually restoring parts of the core area of the raised bog back to a favourable condition has been carried out over the last few years. The raised bog habitat is one of the main areas of nature conservation interest on the site, despite its somewhat degraded state due to previous drainage and afforestation. Raised bogs are an EU Annex 1 habitat: "7120 Degraded raised bogs still capable of natural regeneration" and a UK Biodiversity Action Plan Priority Habitat, as well as an LBAP habitat.

Restoration was started in 2000 when the area of raised bog in the north-east of the site (3a) was cleared of conifers. A second area of raised bog (3b) was cleared of conifers and damming of ditches in 2004, with the final phase of conifer removal and more dams added in 2005 (3c). Work to clear invading scrub was carried out between: - 2010 – 2012, with limited success.

In 2012 a “Boginar” event was organised by the Portmoak Community Woodland Group (PCWG) and held at Portmoak Village Hall to discuss future management options for the sustainability of the raised bog habitat.
Further improvements work was carried out in 2013 after a successful application was made to the

SNH Green Stimulus Peatland Restoration Fund (GSPRF). This involved extensive scrub clearance and spot weeding of cut stumps and young plants and the installation of a further 48 plastic piling dams within the core area along with an independent report into peat stability, hydrology, management and appropriate methods to stabilise the exposed peat face.

In 2014 another successful application was made to the SNH GSPRF to carry out further scrub clearance and mulching work across the core area of the raised bog. The emphasis was to reduce the height of previously ploughed ridgelines and stump height and mulch any remaining large scrub. In addition the sides of several main ditches were lowered to encourage water levels to rise and spread out more easily across the site. In 2015 PCWG submitted a successful application to Living Lomonds Landscape Partnership (LLLP) for funds to commission an independent report considering management options for the site and to carryout reprofiling work to two sections of the exposed peat face on the eastern side of the raised bog and insert several small raised bunds at the western end of one of the main drains to slow down water loss.
In addition Woodland Trust and PCWG jointly funded work in 2016 to renew the eastern set of steps onto the raised bog.

The sequence of works over the last few years has done much to improve the core area of the raised bog-which is an important store of carbon in the area. Surface water is starting to spread over more of the site. Wet areas have the effect of discouraging scrub regeneration whilst encouraging raised bog species to spread-especially sphagnum moss species. The area is developing into a mosaic of raised bog habitat consisting of: heather, wavy hair grass, mosses (mainly sphagnum species) cotton grass and heather. It is hoped the reprofiling work along the steep edge of the exposed cut face of the raised bog will slow down water loss from bog and reduce drying out around the perimeter. In areas of standing water there is frequent sphagnum cuspidatum with sphagnum recurvum on pool edges. On somewhat drier areas there are frequent tussocks of sphagnum palustre and occasional sphagnum capillifolium and sphagnum fimbriatum. Sphagnum magellanicum has also been reported but is rare. There are also rare patches of cotton grass and cross-leaved heath. Broad-buckler fern is occasionally present in drier areas. The core area of the raised bog is surrounded with a variety of mature seed bearing tree species-mainly downy birch, Sitka spruce, larch and pine. All of which have been successful in colonising the site in the past. Combating regeneration of these species over the raised bog will continue to present challenges in the future. There is abundant sporadic deadwood scattered across the site.

Wildlife
Roe deer and brown hares are frequent visitors to the site. There is a small colony of red squirrel (regular reports of red squirrels; grey squirrels are seen very occasionally). A variety of bird species have been recorded on and around the Moss. The site holds good numbers of green and great spotted woodpecker –both of which are regularly seen and heard. Other birds recorded are: sparrowhawk, tawny owl, buzzard, kestrel, woodcock, jay, wood pigeon, tree creeper, siskin, redpoll along with a wide range of common woodland, garden and farmland species. Numbers swell in the summer months with the arrival of a wide variety of passerines. Several bat boxes were erected in the past, many of which are now in need of replacement.

A wide variety of invertebrates have been recorded; moths (notable species: buff footman, satellite moth), butterflies (notable species: small pearl boarded fritillary, green hairstreak), Odonata (damsel and dragonflies), as well as a wide range of aquatic species, woodland and raised bog specialists.

The Woodland Trust works closely with Butterfly Conservation and SNH recorders in regard to the range of invertebrate species found on-site.

Access
Within the site there is a network of 1,872m of surfaced paths. The loop path (1,472m) encircles and traverses across the core area of the raised bog, and passes through areas of mainly coniferous woodland (Core path PTMK/117). The northern part of the loop forms part of the Michael Bruce Way, a circular route linking the villages of Scotlandwell and Kinnesswood with the Woodland Trust sites of Portmoak Moss and Kilmagad Wood and the Loch Leven Heritage Trail (Core paths PTMK/7, PTMK/103). In addition, there is also a 400m all-abilities surfaced path within the site which avoids the steps. Many informal unsurfaced paths traverse the site, some of which pass over wide drains via sleeper bridges. The informal routes are often muddy in places. There are two public entrances to the site. There is a small parking area on the access track to the main entrance where parking is permitted by the landowner. The wood attracts over 11,000 visits a year.

Community Involvement
There has been considerable local interest in the woodland, starting with fund-raising for the acquisition in 1996 and subsequently through the establishment of the Portmoak Community Woodland Group (PCWG), which is also actively involved with the nearby Kilmagad Wood, also owned by the Woodland Trust Scotland. PCWG is involved with the organisation of activities, events, fundraising, communications and management of the woodland and also collaborates with other community woodland groups across Scotland. In addition to PCWG involvement, there has always been wider local consultation over many issues affecting the woodland, including in 2002 a public consultation meeting to discuss the potential restoration of part of the raised bog area. In 2012 a “Boginar” event was held which included relevant specialist speakers to discuss the future management and long term potential of the raised bog.

3.0 PUBLIC ACCESS INFORMATION

3.1 Getting there

Portmoak Moss lies just south-east of the village of Scotland Well. The wood can be most easily reached on foot from the village centre of Scotlandwell: From the main road junction follow the B920 south for 150m to the edge of the village, then turn right down a track (signpost 'Portmoak Moss') for a further 180m to enter the wood through a wheelchair-access kissing gate. For car users, there is a lay-by on the track where parking is permitted by the landowner.

Portmoak Moss can be reached by public transport by bus to Scotlandwell. From the bus stop in the village centre directions are as described above.
The closest rail access is at Markinch, near Glenrothes or alternatively Cardenden and then by the regular bus services to Scotlandwell.

There is an excellent path network in the area which feeds into the site from several directions and travels through a variety of landscapes.

Nearest bus stop - Scotlandwell (0.5km) regular services via Glenrothes, Cardenden, Kinross or Milnathort. Further information about public transport is available from Traveline - www.travelinescotland.com or phone 0871 200 22 33. (January 2017)

Nearest Public toilet - Kinross Services 24hrs, M90, J6, 11km, 7 miles, (with disabled access).
There are pub and hotel facilities at Scotlandwell and Kinross and numerous cafes, village and farm shops in the area.

3.2 Access / Walks

Within the site the path network passes through a varied landscape of conifer and broadleaved woodland and open ground over the core area of the raised bog habitat. There is 1,472m of surfaced path and 3 flights of steps which loops around and traverses across the central area of the raised bog (Core Path PTMK/117), and directly links up with the 2 site entrances. There is a long-standing Right of Way at the northern section of the path which forms part of the Michael Bruce Way (Core Path PTMK/7) -which is a popular circular route (5km, 3 miles) linking the villages of Scotlandwell and Kinnesswood with the Woodland Trust sites of Portmoak Moss and Kilmagad Wood. Core Path PTMK/7 connects with Core Path PTMK/103 and from there links directly onto the Loch Leven Heritage Trail at section Core Path PTMK/100.
In addition, there is also a short stone-surfaced all-abilities route of 400m within the site which avoids the steps. Many informal paths can also be found within the site, some pass over wide drains, via sleeper bridges. The informal routes are often muddy in places.

4.0 LONG TERM POLICY

Woodland
To develop, over time, a resilient, sustainable and diverse woodland habitat. Consisting, predominately, of mixed native species with a diverse range of age classes. Over approximately two thirds of the site. Relating to NVC classes W4 (Betula pubescens-Molina caerulea woodland sub-community types, W16 (Quercus spp.-Betula spp.-Deschampsia flexuosa woodland sub-communities)/W17 (Quercus petraea-Betula pubescens-Dicranium majus woodland sub-communities). Species composition will be predominantly naturally regenerated native broadleaved trees. Downy birch, willows and rowan will make up the bulk of the tree canopy. There will be a secure ground flora predominately of: mosses, grasses and ferns. A conifer component of approximately 20-30% overall will be maintained and will be dominated by Scots pine.

Due to the increasing instability and heightened risk of large scale windblow amongst the crops of Sitka spruce a programme of clearfelling and restoration will be implemented in the most vulnerable areas during the period of this plan. The clearfelled areas will be encouraged to develop into mixed native woodland. Existing areas of Scots pine will be retained for as long as possible to provide a suitable habitat and food source for the small colony of red squirrels on the site. Any gaps that occur will be allowed to regenerate naturally into mixed woodland. Natural regeneration will be supplemented by enrichment planting as required with native species such as: sessile oak and alder, etc along with groups of Scots pine on the drier soils. Existing regenerated areas will continue to develop naturally under a low impact silvicultural system of management.

Raised Bog
The long term intention is that ground conditions over the core area (NVC type M18 Erica – Sphagnum bog) will be maintained as a raised bog habitat with open wet ground interspersed with spreading open pools and drier patches. Scattered across the site will be the occasional single tree and small clump of downy birch and occasional willows - these will require regular on-going management. Standing and fallen deadwood will arise mainly from cut scrub and windblown perimeter trees. The ground flora will continue to be a mosaic dominated by sphagnum moss species, cotton grass, heather, herbs and grasses.

Evidence from similar sites has shown that if water levels can be kept high and tree regeneration suppressed, then a gradual re-colonisation of native raised bog plant communities will occur over a period of decades. However, it should also be realised that each raised bog restoration is an experiment, and that not all sites have the potential to recover sufficiently to become sustainable. If, despite all the remedial work done to restore the raised bog, vigorous regeneration of birch and mixed conifers continue to pose restoration problems, alternative options for future management will be considered at the next Management Plan review in 2022. An alternative option to be considered at that point may be reversion of the whole restoration area to Wet Woodland (a UK BAP Priority Habitat). Wet woodland would have been the long-term objective for the raised peat area had the raised bog restoration not been undertaken.

The core site of the raised bog will continue to be managed over the next 5 years as a raised bog habitat for the benefit and encouragement of associated raised bog flora and fauna e.g. mosses, plants, Odonata species, other invertebrates, amphibians, birds and mammals. The success of the project will be reviewed at the next Management Plan review in 2022.

A narrow strip of lagg fen will be established and allowed to develop between: the reprofiled raised bog edge and the clearfell area in compartment 2a.

The water filled deep drains in sub compartment 3c are recognised as important habitats for aquatic and Odonata invertebrates. These will be managed as narrow strips of open ground. Any tree regeneration which encroaches upon the drains will be routinely removed.

Further opportunities for funding will be considered by the Woodland Trust to aid proactive management and maintenance of the raised bog habitat.

National Nature Reserve Designation
The Woodland Trust Scotland will continue to discuss with SNH the possibility of inclusion of Portmoak Moss within the wider Loch Leven NNR wetland catchment.

Informal Public Access
The site will provide quiet informal access, in accordance with the Scottish Outdoor Access Code, for local users as well as visitors accessing the site via the Michael Bruce Way and Loch Leven Heritage Trail. The raised bog area and surrounding woodland will also continue to attract visitors with an interest in conservation and species monitoring. The managed path network will continue to be maintained to provide access to both the woodland and raised bog habitats. Regular inspections will be undertaken with regard to tree safety and other access features. Remedial work will be carried out as needed. There will be some areas of woodland left as wildlife refuges where access will not be encouraged e.g. small pearl boarded fritillary breeding zone in compartment 1b. The paths will link well into the surrounding path network and where possible the existing network of unmanaged paths will be retained.

Community Involvement
The Portmoak Community Woodland Group will continue to be actively involved with the on-going management of the wood through regular updates at their meetings and work days to undertake various tasks. Opportunities for the group to take over full time management of the site will continue to be encouraged and explored by the Trust.
The local community will continue to be informed by the Trust regarding future management of the site and briefed, as required, regarding work taking place on the site. Wider public consultation will also be undertaken whenever the Management Plan is reviewed.

5.0 KEY FEATURES

The Key Features of the site are identified and described below. They encapsulate what is important about the site. The short and long-term objectives are stated and any management necessary to maintain and improve the Key Feature.

5.1 Informal Public Access

Description

A stone surfaced path loop of 1472m passes through both woodland and the bog restoration area. There is also a short all-abilities route of 400m which avoids the steps. The northern part of the loop is a long-standing Right of Way and forms part of the Michael Bruce Way, a circular route linking the villages of Scotlandwell and Kinnesswood with the Woodland Trust sites of Portmoak Moss and Kilmagad Wood (core path PTMK/7 and PTMK/117). The surfaced path is supported on geotextile and is finished with type I aggregate. The path is in good condition throughout. There are two public entrances to the site. Although there is no car park, there is a lay-by on the access track to the main entrance where parking is permitted by the landowner. There are also a number of informal desire lines throughout the woodland.

Significance

The paths are well used by local people and visitors alike and offer scope for all abilities access. The raised bog restoration is likely to attract additional visitors with a conservation interest including educational group visits. It is estimated over 11,000 visits per year to Portmoak Moss are made. The current level of public use is defined as WT Access Category A (High: Regularly used at all times of year; more than 15-20 people using one entrance every day).

Opportunities & Constraints

Constraints:
Deep soft peat limits the carrying capacity of path.
On the raised bog restoration area the sphagnum species are sensitive to trampling
Rising water levels following ditch blocking may affect current access routes and require diversion or the construction of boardwalks
Water-filled ditches impede access in some areas
Opportunities:
Respond reactively to opportunities, particularly regarding additional links to long distance routes.

Factors Causing Change

Long term Objective (50 years+)

The site will provide quiet informal recreation to mainly local users as well as visitors using the Michael Bruce Way.
The main path network will be maintained as well-drained and clear of obstructions and overhanging braches.
The managed path network will offer experience of both woodland and raised bog habitats.
The restored raised bog will be interpreted to visitors.
There will be some areas of woodland left as wildlife refuges where access will not be encouraged.

Short term management Objectives for the plan period (5 years)

Access provision will be in keeping with WT access guidelines and site access coding (A), and according to the Scottish Outdoor Access Code. Surfaced paths will be maintained in good condition and kept well-drained. Managed paths will be kept free from vegetation, obstacles and over-hanging branches, and bridges & boardwalks maintained in good condition by annual inspection and maintenance. Well-used routes will be kept safe by periodic tree safety inspection and remedial work.

5.2 Semi Natural Open Ground Habitat

Description

Raised Bog: Portmoak Moss is the remnant core of a raised peat bog, surrounded by a sheer face of cut peat from 2 to 3m high around much of the perimeter. There are numerous deep drainage channels on both the raised and lower parts of the site.
In 2002 a feasibility study showed that it may be possible to restore the core area of the peat dome to a functional raised bog by removing tree cover and damming ditches. The project covers approximately 12ha of the site. Since clearance of the conifers and damming occurred sphagnum and other bog species have, over parts of the site, made a healthy recovery. In areas of standing water there is frequent sphagnum cuspidatum with sphagnum recurvum on pool edges. On somewhat drier areas there are frequent tussocks of sphagnum palustre and occasional sphagnum capillifolium and sphagnum fimbriatum. Sphagnum magellanicum has also been reported but is rare.
It is likely that the raised bog ecosystem at Portmoak Moss will take many years to recover. Sphagnum moss, the key to the raised bog vegetation community, requires water levels within 40cm of the surface for most of the year: Initial monitoring results show that the initial tree felling and damming work managed to reach this target on parts of the site. However, complete restoration will require many years of on-going control of tree regeneration and dam maintenance before the ecosystem can be said to be self-sustaining. However, the continual challenge of seeding by natural regeneration may call into question long term sustainability of the project.
To date a combination of methods have been applied to aid the process of bog restoration over core area. Including: clear felling of the commercial conifer crop, installing dams, removal of scrub regeneration by: cutting/pulling/strimming and chemical weed control, increasing the number of dams, heavy duty mulching to even out the surface of the raised bog and reduced tree stumps (to encourage surface water to spread out across the site), main drain bunding, and reprofiling of the raised bog cut peat edge to reduce water loss, drying out and stabilise the cut edge.
For several years after clearfelling and dam installation the site was left to settle. During this time the water level was regularly monitored by PCWG. Occasional scrub control took place. However, tree seeding was prolific and the limited scrub control had little impact.
A three year project with Scottish Wildlife Trust (SWT) 2010-2012 was developed to try and get on top of the regeneration, with limited success.
Further restoration work was carried out in 2013 and 2014 using specialist contractors and equipment as part of the SNH Green Stimulus Peatland Restoration Fund (GSPRF) on the core area of the raised bog. The work followed SNH best practice guidance and involved a combination of techniques (cut stump treatment and spot weeding of scrub with Glyphosate, installing additional dams and heavy duty mulching to level out parts of the site). The work has, initially, been effective at removing and reducing reoccurring natural regeneration across parts of the site, and helping to raise water levels and has also improved the spread of surface water across parts of the raised bog.
In 2016 two sections of the steep and exposed perimeter face of the raised bog were reprofiled (in cpts 2a and 8a). This work was completed following recommendation from the independent report of the raised bog commissioned in 2013 by SNH and involved re-profiling the steep and exposed cut face of the raised bog perimeter by altering the gradient to around 35%, battering the new face and consolidating the slope with adjacent ground vegetation and woody debris. The objective being: to reduce water loss, limit drying out of the perimeter vegetation and stabilise the exposed fringe. Reprofiling has proved successful on other raised bog sites in the UK. The two sections reprofiled are considered trial areas and the outcome will be annually assessed and monitored. At the same time a series of short peat bunds were installed at the western end of the main drain which runs roughly east west across the core area of the site to slow down the flow of water and reduce water flowing off the site via the exposed cut face to the west. The work was supported by a LLLP grant.

Significance

Lowland raised bogs capable of regeneration are an EU Annex 1 habitat and a UK BAP priority habitat as well as an LBAP habitat. The rarity of raised bog as a habitat far outweighs the biodiversity value of the conifer plantation that had been planted on it, and contributes to the overall site biodiversity. The restoration project meets the WT Management Principle of protecting and conserving important semi-natural habitats.

Opportunities & Constraints

Constraints:
Regeneration of birch and mixed conifers in the existing open areas is often prolific and vigorous and will need to be continually managed for many years to come, and may ultimately prove unsustainable.

Restoration of bogs is resource hungry and will demand potentially unsustainable resource commitments from the WT and PCWG.
The fragile peat surface is easily damaged by machinery.
Sphagnum moss is sensitive to trampling.
Previous use of the site has seriously modified the natural raised bog vegetation communities and the extent to which they will recover is unknown.
Peat cutting around the edge of the primary peat surface has modified the natural 'groundwater mound' and disrupted the hydrology of the site. As a result the degree to which a sustainable raised water table can be achieved is still unknown.

Opportunities:
Lowland raised bogs are a very rare habitat, in both a national and international context, and provide an important carbon sink. Restoration at Portmoak presents an opportunity for WTS and the local CWG to make a significant contribution to the conservation of a network of important raised bog sites in Scotland.
To continue to work in partnership with relevant organisations in controlling tree regeneration, raising water levels and protecting the exposed edge of the bog and enhancing and conserving the raised bog habitat.
The process of restoration presents an excellent opportunity to engage people in the practical management of the site.
There are good opportunities for interpretation and education throughout the process of restoration.
Restoration of the raised bog (if sustainable) will add considerably to the biodiversity value of the site as a whole with a predicted increase in raised bog plant and invertebrate species, and possibly breeding birds (e.g. snipe, woodcock, etc)

Factors Causing Change

Succession woodland, drying out, increased scrub encroachment, changes in water level and water loss via the exposed perimeter cut face.

Long term Objective (50 years+)

To restore raised bog vegetation on the core area of the raised bog (approximately 12ha). Success will be measured by the on-going development of NVC class M18 Erica tetralix-Sphagnum papillosum type vegetation. The aim is to achieve 50% of M18 type vegetation over the core site within sub-cpts 3a and 3b by 2022. Thereafter, it is expected that occasional intervention will be required, as and when, across the core area to control any emerging natural regeneration. If 50% of the core area is not seen to be self-sustaining by the time of the Management Plan review in 2022, and no sustainable method of scrub control exists at that time, then alternative options for the site will be considered such as: reversion to wet woodland -a UK BAP priority habitat.

Short term management Objectives for the plan period (5 years)

During the period of this plan:
Ensure light levels and water levels in the core raised peat area are maintained in a condition favourable to the recovery of a variety of characteristic bog species.
Achieved by:
(a) Scrub management over the core area of the raised bog: the Woodland Trust will commit up to £1,000/annum on an annual programme of scrub clearance over the core area of the raised bog during the period of this plan. Additional external funding will also be considered to support this objective, as necessary.
(b) Continue to work in partnership with relevant supportive organisations e.g. SNH, PCWG, etc.
(c) Maintain all existing dams so that there is a fall of no more 20cm between consecutive ditches, to achieve a target water level within 40cm of the surface across as much of the core area as possible, and periodic monitoring of water levels.
(d)The area within and around all the dammed deep water-filled main drain habitats within cpt 3c along with any remaining deep drain and open water sections in compartment 3a & 3b will continue to be managed for the benefit of Odonata species (main breeding zones) and other aquatic invertebrates and retained as open water/ground M18 type habitat and any invasive scrub cleared away from these areas.
(e)Rhododendron ponticum in cpts 3b and 8a: continue with removal of the localised group of Rhododendron on the north east corner of the core area of raised bog. Carry out annual control of any remerging plants.
(f) Consider carrying out further reprofiling works-subject to successful outcome of the trial areas – funding permitted.
(g) Other types of funded projects designed to encourage M18 vegetation to stabilise and spread to an acceptable level across most of the core area will also be considered during this period.

It is hoped that in many areas of the core area of the raised bog surface wetness will increase and as a result scrub seeding and regeneration will start to die off and find it increasingly difficult to germinate. If this is not seen to occur by the time of the Management Plan review in 2022, and no self-sustaining method of scrub control exists at that time, then alternative options for the site will be considered such as: reversion to wet woodland -a UK BAP priority habitat.

5.3 Long Established Woodland of Plantation Origin

Description

Two areas of woodland (5a & 7a) are shown as Long Established Woodland of Plantation Origin (LEPO) in the SNH Ancient Woodland Inventory (AWI). However, the 1856 1st edition OS map shows that some other parts of the site could also be classed as LEPO, including parts of 1a, 2a, 4a and 8a. The 1856 map shows the woodland areas with straight edges defined by drains (all of which are still present) and are most likely early 19th century attempts to provide drainage and shelter belts to improve grazing quality. The current canopy is defined either by 1960's conifer planting or by semi-natural birch that has regenerated where conifer establishment has failed. There is also the occasional older, mature pine or birch that pre-dates FC planting. The ground flora in these compartments does not vary significantly from that in the rest of the wood, being defined by grasses and broad-buckler fern (approx NVC W4a) in the more open areas and bare ground under the denser conifers. The older ditches are valuable in that they are likely to be a refuge for remnants of the semi-natural bog-vegetation present before drainage and tree planting dried the site.

Significance

The woodland is on the SNH Ancient Woodland Inventory (AWI) as LEPO, and has existed since at least 1856, which indicates the potential for a relatively high biodiversity potential in comparison to the rest of the wood. The management of LEPO areas meets the Trusts corporate objectives of 'Improving the biodiversity of woods' and 'Preventing the loss of ancient woodland'.

Opportunities & Constraints

Opportunities:
LEPO areas on the edge of the peat dome will be retained as woodland to provide continuity of habitat
Biodiversity value of the retained LEPO areas will be maintained and improved by management as mixed or broadleaved woodland
Ditches in LEPO areas may contain remnant semi-natural bog vegetation

Constraints:
Conifer areas are on deep peat and are likely suffering to suffer windblow which will only increase at some point iin the future
Management access is restricted on deep peats

Factors Causing Change

Windblow.

Long term Objective (50 years+)

To create and maintain a diverse, mixed age and mixed species woodland habitat in perpetuity with secure and developing the ancient woodland communities. Species will be predominantly broadleaved with birch the main canopy tree, approximating to NVC classes W4, W16 / W17, with a ground flora of grasses and ferns. There will also be a conifer component of approximately 25% overall to provide diversity and red squirrel habitat, including some retained conifers from the present time - wind permitting.

Short term management Objectives for the plan period (5 years)

Management of these areas will be via a low impact silvicultural system of minimum intervention within the plan period. In 5a birch regeneration will continue to develop and become fully established. Further birch regeneration is expected to develop over time.
The habitat in cpt 7a is expected to remain in its current condition, with occasional broadleaved regeneration.

5.4 Secondary Woodland

Description

The secondary woodland (compartments: 2a, 4a, part of 5a, 5b, 5c, 6a, part of 6b, 8a) consist mainly of unthinned mixed commercial conifer stands planted between 1960 and 1963. The main species are Sitka spruce and Scots pine, with some Norway spruce, lodgepole pine, hybrid larch, and the occasional grand and noble fir. Sporadic patches of self-sown downy birch are found throughout. The occasional mature Scots pine can also be found which predates the 1960's planting. Poorly drained deep peat, combined with a lack of thinning and the crops reaching commercial maturity have produced drawn up, closely spaced stands which have become very susceptible to windblow. The Sitka and Norway spruce are particularly vulnerable and pockets of windblow are found throughout many areas of the commercial conifers. Incidence of windblow amongst the conifers is increasing. Standing and lying deadwood is frequent to abundant in the unthinned conifer areas. The broadleaved woodland component consists predominantly of wet woodland (W4) and W16/W17 and some W18 type woodland; mainly downy birch, with the occasional oak, rowan, willow, sycamore and ash. Many of these are trees that have regenerated in open areas where the conifers did not establish well, there are also scattered mature trees present which predate the conifers. An area in the southeast of the site (cpt 1b) is now showing dense downy birch regeneration following clearance of windblown conifers in 1999. Secondary woodland has also become established in cpt 3c and parts of 8a.

Ground flora is almost absent under the dense stands of spruce, and in more open areas is dominated by common damp woodland species (NVC classes W4 and W16) such as broad buckler fern, wavy hair-grass and mosses, including remnants of various sphagnum species. In the drier areas on the raised peat there are patches of blaeberry and heather in more open woodland and bracken and bramble on woodland edges.

Roe deer, hares and red squirrels (grey squirrels are occasional visitors.) are present and often seen. Numerous breeding bird species have been recorded including: greater spotted woodpecker, green woodpecker, long-eared owl and goldcrest and many other transitory birds visit the site throughout the year. Bats are known to breed on site e.g. pipistrelle. Bats are often seen out hunting of an evening.
The site is an important area for a diverse range of invertebrates, fungi and mosses.

Significance

The woodland is important locally as an integral part of the landscape and is well used and appreciated by the local community. The site is a mosaic of varied habitats with high biodiversity value: ranging from an open ground raised bog habitat through to wet woodland-both of which are UK BAP Priority habitats. The woodland habitat supports a small colony of red squirrel, a UK BAP species, whilst the raised bog is an important area for a range of sphagnum species and invertebrates. The management of the woodland supports the Trusts corporate objective of 'Improving the biodiversity of woods'.

Opportunities & Constraints

Opportunities:
To maintain and improve the biodiversity value of the woodland areas by regenerating wind-damaged areas as mixed woodland containing both broadleaves and conifers.

Constraints:
Wind damage is a constant potential threat in all unthinned and commercially mature conifer areas growing on deep peat.
Large areas of windblow, and restricted management access will make clearance and ground preparation difficult.
Browsing by deer may reduce natural regeneration in places and may necessitate additional enrichment planting in the future.

Factors Causing Change

Frequent windblow

Long term Objective (50 years+)

To create and maintain diverse, predominately native, broadleaved woodland with a mixed conifer component, with a diverse range of age classes. Downy birch will be the main canopy tree, representative of NVC classes: W4, W16, W17 and W18, with a ground flora mainly composed of grasses, ferns and mosses. There will also be a conifer component (20-30% overall, mainly Scots pine) to provide diversity and red squirrel habitat. Some scattered stands of existing mixed conifers will be retained in places, ,wind permitting, and more open ground and wet scrapes created within the clearfell zones (sub-compartments 2a, 4a and the eastern part of 8a) to create a mosaic of mixed habitats within a matrix of predominately native woodland. There will be more open ground habitat through the creation of new rides and wetland areas to improve species diversity. The transition from commercial conifer to mixed native woodland will follow an on-going program of planned works and will focus on area's which are increasingly vulnerable to large scale windblow.

Short term management Objectives for the plan period (5 years)

The unthinned commercial conifer crop of predominately Sitka spruce in compartments 2a, 4a and the north eastern section of compartment 8a is increasingly at risk of large scale windthrow due to increasing instability. Sporadic windthrow of conifers has occurred in several compartments in recent years and is highly likely to intensify and become more widespread. A transition to native woodland will be managed as follows during the period of this plan:
(a) Cpts 2a, 4a and part of 8a (approximately 10.60ha) will be clearfelled within the current plan period and the cleared sites prepared to encourage seeding by natural regeneration of native species. Progress of natural regeneration will be assessed at the next plan review.
(b)Where appropriate, enrichment planting in the form of scattered groups of mixed native tree species will also be included as part of the restructuring work over the sites. A mix of: sessile oak, alder, rowan, hawthorn, holly and hazel will be planted using locally sourced Scottish grown planting stock. Planted in tree shelters and staked, and annually maintained until fully established.
(c) Within the clearfell restructuring sites new rides will be installed to facilitate informal access, along with the occasional wet scrape. To improve habitat and species diversity for invertebrates and amphibians.
(d) Along the perimeter of the reprofiled raised bog in compartment 2a, between the raised bog and the regenerating native woodland, a swath of open ground area (approximately 10m wide) will be left as an open ground scrape to develop as a transitional zone of lagg fen habitat between the upper and lower peat levels.
(e) Some existing conifer areas in compartments: 5a (part of), 5b, 5c, 6a, 6b and 8a (parts of) will be retained (especially where Scots pine is a major component), wind permitting, and managed by minimum intervention to maintain a mixed woodland habitat during the period of this plan. Where patches of windblow occur, restocking will be by natural regeneration: Windblown timber will be left in situ, where possible, to provided fallen deadwood habitat, and cut and cleared, as necessary, to ensure management access is maintained.
(f) The woodland areas in compartments: 1a, 1b, and in 3c (where bog-specialist species failed to respond and became well established by naturally regenerated downy birch, with occasional willow, rowan, pine, larch and spruce) will continue to be managed as downy birch dominated woodland, NVC Type either: W4 or W17/W18 - as site conditions dictate. Non-native conifers amongst the birch in cpt 3c e.g. Sitka spruce will continue to be gradually removed. Parts of cpt 1b (where the open ground wayleave is) will continue to be managed for the benefit of the colony of small pearl boarded fritillary butterfly.
(g) Rhododendron ponticum at the Curling Pond: the large bushes on the western side of the Curling Pond (immediately behind the derelict building) risk spreading into the woodland through cpt 1a. Obtain permission from the Curling Club Committee to remove all Rhododendrons in this area and control regrowth annually until eradicated.

6.0 WORK PROGRAMME

Year	Type of Work	Description	Due By

APPENDIX 1: COMPARTMENT DESCRIPTIONS

Cpt No.	Area (ha)	Main Species	Year	Management Regime	Major Management Constraints	Key Features Present	Designations
1a	1.11	Birch (downy/silver)	2000	Min-intervention	Mostly wet ground/exposed site	Informal Public Access	
Ground conditions: peaty, extremely wet with deep water-filled ditches. The ground was heavily disturbed during conifer clearance in 1999. The predominant species is naturally regenerated downy birch with occasional goat willow, grey willow and rowan, with occasional mature trees and coppice regrowth. NVC type, predominately: W4 Wet Woodland with a narrow strip of W17 oak - birch woodland along the eastern boundary. An obsolete wayleave (powerline) cuts through a part of the sub-compartment. A stacking/turning area for the site lies on the northern edge of this block. A narrow strip of mature oak, pine and spruce forms the eastern boundary of the site. Occasionally a mature conifer blows over, although the strip as a whole has remained firm, providing shelter and an attractive visual screen to the naturally regenerating wet woodland area in 1b. The ground flora beneath the birch consists of abundant mosses and grasses, frequent ferns and mosses, with frequent marsh and dog violet, and common sorrel Ground flora is less prevalent beneath the conifers. There is occasional regeneration of downy birch. There is ample deadwood due to the occasional windblown conifer in the strip on the eastern boundary.							
1b	4.54	Birch (downy/silver)	2000	Min-intervention	Mostly wet ground/exposed site	Informal Public Access	

Ground conditions: peaty and extremely wet with deep water-filled ditches. The ground was heavily disturbed during conifer clearance in 1999. Naturally regenerated downy birch predominates along with the occasional goat willow, grey willow and rowan. Regeneration is dense throughout most of the site. There is a scattered overstorey of mature downy birch on the western side of the sub-compartment. An obsolete wayleave (powerline) of open ground bisects the sub-compartment-this is an important breeding and feeding area for small pearl boarded fritillary. Regenerated trees around the open ground area were cut back and the edges scalloped and debris mulched in 2014. A new strip of open ground parallel to the existing was created at the same time to improve and expand the habitat. The vegetation community that developed following clearfelling was predominantly NVC M23 Juncus effusus/acutiflorus-Galium palustre rush-pasture, overwhelmingly dominated by Rushes (Juncus effusus) with abundant grasses consisting of: Yorkshire fog (Holcus lanatus), velvet bent (Agrostis canina), wavy hair-grass (Deschampsia flexuosa) and tufted hair-grass (Deschampsia cespitosa). There was also frequent common sorrel (Rumex acetosa). For several years following clearfell rosebay willowherb (Chamaenerion angustifolium) and brambles (Rubus ideaus and Rubus fruticosus) were locally abundant-these species are often associated with disturbed ground and persisted on the site for several years afterwards. The rosebay and bramble have gradually disappeared as light levels change and a dense canopy of natural regenerated trees has become established. As a result of this change mosses are now more abundant across the site. Some grasses, soft rush and common sorrel have continued, whilst marsh and dog violets have increased in abundance-especially in and around areas of light woodland and open ground (the old wayleave). Much of the woodland in this compartment has developed into NVC type W4 Wet Woodland. Deer browsing has not prevented regeneration in this area-although roe deer are frequently seen. Deadwood is currently limited to gradually decaying mature trees, snapped off boughs and the occasional windblown tree.							
2a	5.67	Sitka spruce	1960	High forest		Informal Public Access	

An area of mature unthinned mixed conifers, predominated by Sitka spruce. This compartment is on the lower peat level and is relatively well-drained in places. It is bounded on the west by the reprofiled (2016) peat-face and by the timber extraction route to its north. The major part of the compartment consists of an intimate mix of Sitka spruce and Scots pine. The pine has been completely suppressed by the spruce and is very drawn up and moribund. Hence, many of the pines are standing dead and there is frequent wind snap. This has had the effect of a self-thinning, resulting in the Sitka spruce being well drawn up and of reasonable form. There are a few broadleaves scattered throughout the crop (mainly naturally regenerated mainly downy birch). Towards its eastern edge, the canopy consists of mature Norway spruce and downy birch. The north-eastern lobe of the compartment consists almost entirely of Sitka spruce. Sporadic windthrow has occurred throughout the compartment in recent times and is highly likely to intensify. The combination of: a generally deep peaty soil, a high water table, a lack of thinning and the rotational age of the trees will ensure that crop stability continues to decrease. As a result, the risk of a large scale windblow event occurring will continue to increase. It is important that the crop is clearfelled before this occurs. The standing timber resource is currently estimated at approximately 340 cubic metres/ha. There is little or no ground flora or understorey under the dense canopy. . Wood sorrel and several mosses are frequently found. In lighter areas to the west there are occasional grasses and frequent ferns. Spruce seedlings occur throughout, although lack of light prevents their establishment. Aerial and fallen deadwood is abundant due to the large amount of standing and fallen dead pine and pockets of windblow.							
3a	6.00	Open ground	2005	Non-wood habitat	Mostly wet ground/exposed site, Sensitive habitats/species on or adjacent to site	Informal Public Access	

Forms a significant part of the core area of the raised bog peat dome.
The site was clearfelled of commercial conifers in 2000. Ground vegetation was almost absent following clearfell but soon developed, over time into a mosaic of wavy hair-grass (Deschampsia flexuosa), mosses (mainly sphagnum species), cotton grass (Eriophorum angustifolium), soft rush (Juncus effusus) and heather (Calluna vulgaris). Dense downy birch, Sitka spruce and a few pine began to colonise many areas, particularly at the edges of the cleared area and began to threaten the raised bog open ground habitat- over time much of this has been controlled, prolific seeding from surrounding mature trees continues to offer a threat to the long term. Deadwood is scattered across the site and present in the form of: a few standing dead pines, decaying lop and top from scrub control and numerous conifer stumps from the original clearfell. Since tree clearance a variety of works has been undertaken to help improve the raised bog habitat. These include: damming, tree and scrub clearance and control, surface mulching, drain bunding and infilling and reprofiling of the eastern edge of the exposed steep cut face of the raised bog. The signs are promising, there has been a gradual rising of the water table and surface water is now spreading out over parts of the site. Increased water levels will help to control seedling scrub, in due course, across these areas of standing water. Sphagnum species have shown a strong recovery over parts of the site. In areas of standing water there is frequent sphagnum cuspidatum with sphagnum recurvum on pool edges. On somewhat drier areas there are frequent tussocks of sphagnum palustre and occasional sphagnum capillifolium and sphagnum fimbriatum. Sphagnum magellanicum has also been reported but is rare.

Large swathes of drier ground remain scattered throughout. The largest area of which is located in compartment 3b. These areas are dominated by grassland species such as: wavy hair-grass (Deschampsia flexuosa), tufted hair-grass (Deschampsia cespitosia), Yorkshire fog (Holcus lanatus), creeping soft grass (Holcus mollis), and purple moor grass (Molinia caerulea) with occasional heather and broad-buckler fern (Dryopteris dilitata).
The on-going programme of works has helped the water level to rise and gradually spread across parts of the site. Conditions for bog species to develop are improving. As a result sphagnum and other bog species have started to expand their range and re-colonise new areas, whilst at the same time the rewetting is creating unsuitable conditions for the drier species to survive. It is hoped that the water levels will continue to spread outward and gradually suppress any existing tree regeneration.
There is abundant deadwood across the site in the form of several standing dead pines, decaying brash and lop and top and numerous conifer stumps.

3b	5.37	Open ground	2005	Non-wood habitat	Management factors (eg grazing etc), Mostly wet ground/exposed site, Sensitive habitats/species on or adjacent to site	Informal Public Access	

Part of the core raised bog peat dome, and bounded by the cut peat-face along its south-western edge. All the commercial conifers (Sitka spruce and lodgepole pine, planted 1960) were removed in 2004. Ground vegetation was almost absent following clearfell but soon developed, over time into a mosaic of wavy hair-grass (Deschampsia flexuosa), mosses (mainly sphagnum species), cotton grass (Eriophorum angustifolium), soft rush (Juncus effusus) and heather (Calluna vulgaris). Dense downy birch, Sitka spruce and a few pine began to colonise many areas, particularly at the edges of the cleared area and began to threaten the raised bog open ground habitat- over time much of this has been controlled, prolific seeding from surrounding mature trees continues to offer a threat to the long term. Deadwood is scattered across the site and present in the form of: a few standing dead pines, decaying lop and top from scrub control and numerous conifer stumps from the original clearfell. Since tree clearance a variety of works has been undertaken to help improve the raised bog habitat. These include: damming, tree and scrub clearance and control, surface mulching, drain bunding and infilling and reprofiling of the eastern edge of the exposed steep cut face of the raised bog. The signs are promising, there has been a gradual rising of the water table and surface water is now spreading out over parts of the site. Increased water levels will help to control seedling scrub, in due course, across these areas of standing water. Sphagnum species have shown a strong recovery over parts of the site. In areas of standing water there is frequent sphagnum cuspidatum with sphagnum recurvum on pool edges. On somewhat drier areas there are frequent tussocks of sphagnum palustre and occasional sphagnum capillifolium and sphagnum fimbriatum. Sphagnum magellanicum has also been reported but is rare.
Large swathes of drier ground remain scattered throughout with the largest grassland area is found in this compartment and is dominated by acidic loving grassland species such as: wavy hair-grass (Deschampsia flexuosa), tufted hair-grass (Deschampsia cespitosia), Yorkshire fog (Holcus lanatus), creeping soft grass (Holcus mollis), purple moor grass (Molinia caerulea) with occasional heather and broad-buckler fern (Dryopteris dilitata).
The on-going programme of works has helped the water level to rise and gradually spread across parts of the site. Conditions for bog species to develop are improving over parts of the site. As a result sphagnum and other bog species have started to expand their range and re-colonise new areas, whilst at the same time the rewetting is creating unsuitable conditions for the drier species to survive. It is hoped that the water levels will continue to spread outward and gradually suppress any existing tree regeneration.
There is abundant deadwood across the site in the form of several standing dead pines, decaying brash and lop and top and numerous conifer stumps.
On the drier areas (especially to the east of the sub-compartment) there are frequent tussocks of sphagnum palustre and occasional sphagnum capillifolium and sphagnum fimbriatum. Sphagnum magellanicum has also been reported but is rare. There are also rare patches of cotton grass (Eriophorum angustifolium and E. vaginatum) and cross-leaved heath (Erica tetralix). Broad-buckler fern (Dryopteris dilitata) is occasionally present in drier areas.

3c	2.98	Birch (downy/silver)	2005	Min-intervention	Gullies/Deep Valleys/Uneven/ Rocky ground, Management factors (eg grazing etc), Mostly wet ground/exposed site, Sensitive habitats/species on or adjacent to site	Informal Public Access	
Clearfelled in 2005. The area is bounded: on the east by the cut face of the peat; to the south by larch in compartment 5c; to the west by major drainage ditches; to the north-west by the open mature pine woodland of compartment 5b. To the north it marches with the central area of raised bog (sub-compartments 3a and 3b). A narrow belt of larch has been left to the south on the southern edge, along the perimeter of the wood. Although numerous dams were installed in the main drains, the water table did not rise as anticipated. As a result, sphagnum recovery, post felling, has not been as successful as in compartment 3. The majority of sphagnum moss is focused around the main drainage channels-all of which have been dammed. Post felling, the site did however, provided ideal conditions for the natural regeneration of tree species to occur and tree seeding was prolific: dense downy birch, Sitka spruce, pine, larch and willow from the surrounding mature trees successfully colonised the whole site right up to the northern drain boundary and is now extremely well established and have closed canopy and are moving towards pole stage development. Other trees found on site include: a few over-mature pine in the centre of the area and the mature larch strip to the south. There is abundant deadwood in the form of windblown larch, decaying brash and conifer stumps. The area surrounding the dammed main drains is important for sphagnum and other bog species. Whilst the deep water filled drains within sub-cpt 3c provide essential habitat for aquatic invertebrates, especially Odonata species. Hence, the area within and around the dammed deep water-filled main drain habitats within cpt 3c along with any remaining deep drain and the open water sections in compartment 3a & 3b will be maintained and continue to be managed for the benefit of Odonata species (main refugia and breeding zones) and other aquatic invertebrates and retained as open water/ground M18 type habitat and any invasive scrub cleared away from these areas in an irregular scalloped fashion. Some native species will be retained in places to provide dapple shade.						
4a	4.03	Sitka spruce	1960	High forest	Management factors (eg grazing etc), Mostly wet ground/exposed site, No/poor vehicular access to the site	Informal Public Access	

This sub-compartment adjoins the southern edge of sub-compartment 2a and is a dense mixed conifer stand, consisting mainly of an intimate mix of unthinned and drawn up Sitka spruce and lodgepole pine, with occasional pockets of windblow, increasing along the south and eastern boundaries. Within this matrix there are more open groups of downy birch and occasional Scots pine and Norway spruce. Underneath the spruce there is virtually no ground flora. In lighter areas ground flora is frequent to abundant with grasses (mainly Deschampsia flexuosa) and broad-buckler fern (Dryopteris dilitata). There is an abundance of deadwood due to the suppressed lodgepole pine- much of which is standing dead or snapped and fallen. The compartment is partly on the raised peat area, but is surrounded by deep ditches on all four sides, so that it is separated, in a hydrological sense, from the main raised peat area and is drier in parts than sub-compartment 2a. In the west of the compartment the peat surface is disturbed with various hummocks and hollows. A combination of: a wet peaty soil, lack of thinning, and the rotational age of the trees will ensure that crop stability continues to decrease and sporadic windthrow is highly likely to intensify. As a result, the risk of a large scale windblow event occurring will continue to increase. It is important that the crop is clearfelled before this occurs. Management access to this sub compartment is limited and is via sub compartment 2a.
The standing timber resource is currently estimated at approximately 340 cubic metres/ha.

5a	2.87	Birch (downy/silver)	1963	High forest	Management factors (eg grazing etc), Mostly wet ground/exposed site, No/poor vehicular access to the site	Informal Public Access	

A long narrow compartment forming the western boundary of the woodland. The compartment sits on the edge of the raised bog and is bounded by the cut peat-face to the north east. It is bounded by ditches on all other sides. In the centre of the compartment a belt of hybrid larch stretches west from compartment 5c, but to the north and south of this belt most of the compartment consists of an open mix of semi-mature downy birch and grand fir. Many of the grand fir have died standing although the remainder appear healthy. In the far north of the compartment there is a small block of mature Norway spruce. Under the open birch/fir woodland there is regeneration of birch and the occasional conifer and a ground flora of wavy hair-grass (Deschampsia flexuosa) and broad-buckler fern (Dryopteris dilitata), with strong bracken growth along western edge. Browsing damage is low. There is currently only the occasional windblown tree, although there is frequent deadwood from standing and fallen grand fir. The whole sub-compartment is shown as Long-Established Woodland of Plantation Origin (LEPO) on the SNH Ancient Woodland Inventory and is visible as a shelter belt planted between ditches on the 1856 1st edition OS map. As such there is a minor threat to AW communities from shade/wind blow, however ground flora is abundant.

5b	1.26	Scots pine	1963	High forest	Gullies/Deep Valleys/Uneven/ Rocky ground, Management factors (eg grazing etc), No/poor vehicular access to the site, Sensitive habitats/species on or adjacent to site	Informal Public Access	
A block of mixed woodland of predominately Scots pine on a generally dry area of the raised bog. Bounded to the south west by sub-compartment 5a and to the north-west by the cut peat-face running along the edge of sub compartment 6a and on all other sides by the open ground of the core area of raised bog. The southern part consists of Scots pine and downy birch; this is an important feeding area for red squirrel and an attractive route along the path. To the north there is a small area of unthinned Sitka spruce interspersed with Scots pine -planted in 1963. Beneath the unthinned conifers there is little ground flora, but in the more open pine-birch areas there is frequent heather (Calluna vulgaris) and blaeberry (Vaccinium myrtillus), broad-buckler fern (Dryopteris dilitata) and wavy hair-grass (Deschampsia flexuosa). This approximates to a mosaic of NVC type W16, whilst the pine-birch mix is more familiar in appearance to NVC type W18. Occasional mosses present include Dicranum scoparium, Polytrichum commune and Pleurozium schreberi. Surviving raised bog vegetation includes rare patches of common cotton-sedge (Eriophorum angustifolium) and significant patches of sphagnum species. There is frequent birch regeneration in the more open areas, which does not seem to have suffered undue browsing. There is frequent deadwood in the form of windblown trees.							
5c	1.12	Hybrid larch	1963	High forest	Gullies/Deep Valleys/Uneven/ Rocky ground, No/poor vehicular access to the site	Informal Public Access	
Open woodland (80% canopy) of hybrid larch with occasional downy birch regeneration in parts on the southern boundary of the site. The larch has suffered much windblow in the past. However, it now provides a relatively wind firm edge to the boundary. Ground vegetation consists mainly of grasses and ferns in denser areas and bracken in more open areas. There is abundant deadwood as a result of decaying windblown larch. This area of the site is fairly well-drained due to the deep boundary ditch to its south.							

6a	3.56	Mixed conifers	1963	High forest	Management factors (eg grazing etc), Mostly wet ground/exposed site, No/poor vehicular access to the site	Informal Public Access	
A block of mainly conifer woodland forming the north west boundary of the site. Most of which is on the lower peat level, although a narrow belt of trees sits along the western face of the raised bog. To the south part of the area is bounded by the cut peat-face of the raised bog. The western part of the sub-compartment is shown as woodland on the 1857 1st edition OS map (although not shown as LEPO on the SNH Ancient Woodland Inventory). The canopy consists mainly of a mix of mature Scots pine and Sitka spruce in the west (planted 1963) with frequent groups of mature downy birch (particularly along the edges). The rest of the compartment is more mixed with frequent Sitka spruce, Norway spruce, lodgepole pine and downy birch. There is occasional windblow. Generally though most trees appear wind firm on this drier and lower ground. Beneath the birch there is abundant wavy hair-grass (Deschampsia flexuosa) and frequent broad-buckler fern (Dryopteris dilitata), although little tree regeneration. There is little ground flora beneath the conifers. There is occasional dead wood from windblown trees. Minor threat to AW communities from shade, however this is limited by the canopy being opened up from the occasional windblown tree.							
6b	1.37	Birch (downy/silver)	1963	Min-intervention	Mostly wet ground/exposed site, No/poor vehicular access to the site	Informal Public Access	
A varied compartment on the lower peat level, forming the northern boundary to the wood and containing the most diverse area of mixed broadleaves within the site. The canopy consists mainly of mature and semi-mature downy birch but also includes sycamore, ash and rowan. There is also a small strip of Norway spruce and sycamore along part of the northern boundary. The ground flora consists mainly of grasses and ferns with wild raspberry in more open areas and is typical of NVC classes W4 and W16.There is occasional broadleaved (birch) regeneration where light levels allow and frequent deadwood.							
7a	0.53	Birch (downy/silver)	1963	Min-intervention	Management factors (eg grazing etc), Mostly wet ground/exposed site	Informal Public Access	

A narrow belt of open broadleaved woodland, on the edge of the core area of the raised bog, which forms the northern boundary of the site. The canopy is mainly mixed aged birch with occasional rowan and grey willow. Birch seedling regeneration from this strip of woodland onto the raised bog has been a nuisance in the past and requires frequent monitoring. The ground flora comprises of: abundant wavy hair-grass (Deschampsia flexuosa) with frequent broad-buckler fern (Dryopteris dilitata) and occasional patches of bramble and bracken. There is occasional dead wood.
This sub-compartment is shown as woodland on the 1857 1st edition OS map and is shown as Long Established Woodland of Plantation Origin (LEPO) on the SNH Ancient Woodland Inventory. Ancient woodland communities are secure.

8a	2.86	Scots pine	1963	High forest	Gullies/Deep Valleys/Uneven/ Rocky ground, Mostly wet ground/exposed site	Informal Public Access	

Mature conifer woodland (planted 1963) on the lower peat level, bounded on the west by the reprofiled (2016) peat-face, and to the south by the extraction route and stacking area and the site boundary to the north-east. To the east the sub-compartment has an all-abilities surfaced path loop. A deep water filled ditch bisects north-south through the eastern side of the sub compartment. The area to the west of the ditch is a mixture of very well grown; commercially mature Sitka and Norway spruce, which was thinned in 1999 and 2004 to improve stability. Several large pockets of windblow have occurred amongst the mature Sitka and Norway spruce since it was last thinned. The windblown area within the spruce will gradually increase in size and spread. The long term stability of the remaining Sitka and Norway spruce is at risk. It is important that the area of pure spruce is clearfelled before this occurs. The standing timber resource is currently estimated at approximately 340 cubic metres/ha.
The area is shown as open woodland on the 1856 1st edition OS map, although it is not shown on the SNH Ancient Woodland Inventory. The remainder of the compartment consists mainly of an intimate mix of predominately Scots pine, Sitka spruce and downy birch. The pine is reasonably stable and has self-thinned over time. Patches of mixed aged birch fringe the reprofiled peat-face and there are dense patches of birch regeneration in places. There are also occasional older, more mature, Scots pines that pre-date the FC planting. In the pine/birch areas there is occasional windblow. The occurrence and differing ages of the Scots pine makes this an important feeding area for red squirrel.
Under the dense spruce there is much bare ground, but in lighter areas there is frequent broad-bucker fern (Dryopteris dilitata), grasses and common mosses.
Dead wood is evident throughout, especially in the pure spruce areas, in the form of windblown and standing dead trees

Appendix 2: Harvesting operations (20 years)

Forecast Year	Cpt	Operation Type	Work Area (ha)	Estimated vol/ha	Estimated total vol.
2020	2a	Clear Fell	5.67	340	1928
2020	4a	Clear Fell	4.03	340	1370
2020	8a	Clear Fell	0.80	340	272
2030	5a	Clear Fell	2.87	170	488
2030	5c	Clear Fell	1.12	170	190
2030	6a	Clear Fell	3.56	255	907

GLOSSARY

Ancient Woodland

Ancient woods are defined as those where there has been continuous woodland cover since at least 1600 AD. In Scotland ancient woods are defined strictly as sites shown as semi-natural woodland on the 'Roy' maps (a military survey carried out in 1750 AD, which is the best source of historical map evidence) and as woodland all subsequent maps. However, they have been combined with long-established woods of semi-natural origin (originating from between 1750 and 1860) into a single category of Ancient Semi-Natural Woodland to take account of uncertainties in their identification. Ancient woods include Ancient Semi-Natural Woodland and plantations on Ancient Woodland Sites (see below). May support many species that are only found in ancient woodland.

Ancient Semi - Natural Woodland

Stands in ancient woods defined as those consisting predominantly of native trees and shrubs that have not obviously been planted, which have arisen from natural regeneration or coppice regrowth.

Ancient Woodland Site

Stands in ancient woods that have been converted to plantations, of coniferous, broadleaved or mixed species, usually for timber production, including plantations of native species planted so closely together that any semi-natural elements of the understorey have been suppressed.

Beating Up

Replacing any newly planted trees that have died in the first few years after planting.

Broadleaf

A tree having broad leaves (such as oak) rather than needles found on conifers (such as Scots pine).

Canopy

The uppermost layer of vegetation in a woodland, or the upper foliage and branches of an individual tree.

Clearfell

Felling of all trees within a defined area.

Compartment

Permanent management division of a woodland, usually defined on site by permanent features such as roads. See Sub-compartments.

Conifer

A tree having needles, rather than broadleaves, and typically bearing cones.

Continuous Cover forestry

A term used for managing woods to ensure that there are groups or individual trees of different ages scattered over the whole wood and that some mature tree cover is always maintained. Management is by repeated thinning and no large areas are ever completely felled all at once.

Coppice

Trees which are cut back to ground levels at regular intervals (3-25 years).

Exotic (non-native) Species

Species originating from other countries (or other parts of the UK) that have been introduced by humans, deliberately or accidentally.

Field Layer

Layer of small, non-woody herbaceous plants such as bluebells.

Group Fell

The felling of a small group of trees, often to promote natural regeneration or allow planting.

Long Term Retention

Discrete groups of trees (or in some cases single trees) that are retained significantly past their economic felling age. Operations may still be carried out within them and thinning is often necessary to maintain stability.

Minimum Intervention

Areas where no operations (such as thinning) will take place other than to protect public safety or possibly to control invasive exotic species.

Mixed Woodland

Woodland made up of broadleaved and coniferous trees.

National vegetation classification (NVC)

A classification scheme that allows an area of vegetation to be assigned to the standardised type that best matches the combination of plant species that it contains. All woodlands in the UK can be described as being one of 18 main woodland types (W1 - W18), which principally reflect soil and climatic conditions. For example, Upland Oakwoods are type W11, and normally occur on well drained infertile soils in the cooler and wetter north and west of Britain. Each main type can be subdivided into numerous subtypes. Most real woods contain more than one type or sub-type and inevitably some woods are intermediate in character and can't be properly described by any sub type.

Native Species

Species that arrived in Britain without human assistance.

Natural Regeneration

Naturally grown trees from seeds falling from mature trees. Also regeneration from coppicing and suckering.

Origin & Provenance

The provenance of a tree or seed is the place where seed was collected to grow the tree or plant. The origin is the geographical location within the natural range of a species from where seeds/tree originally derives. Thus an acorn collected from a Turkey oak in Edinburgh would have an Edinburgh provenance and a southern European origin.

Re-Stocking

Re-planting an area of woodland, after it has been felled.

Shrub Layer

Formed by woody plants 1-10m tall.

Silviculture

The growing and care of trees in woodlands.

Stand

Trees of one type or species, grouped together within a woodland.

Sub-Compartment

Temporary management division of a compartment, which may change between management plan periods.

Thinning

The felling of a proportion of individual trees within a given area. The remaining trees grow to fill in the space created.

Tubex or Grow or Tuley Tubes

Tubes placed over newly planted trees or natural regeneration that promote growth and provide protection from animals such as rabbits and deer.

Weeding

The control of vegetation immediately around newly planted trees or natural regeneration to promote tree growth until they become established. Either by hand cutting or with carefully selected weed killers such as glyphosate.

Windblow/Windthrow

Trees or groups of trees blown over (usually uprooted) by strong winds and gales.